MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

TCI3121 – COMPUTATIONAL INTELLIGENCE

(All Sections/Groups)

17 October 2018
09:00AM – 11:00AM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 3 pages (including cover page) with 4 structured questions.
2. Answer ALL questions. The distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided.

Question 1

(a) Briefly describe the definition and its origin computational intelligence components: *Evolutionary Computation* and *Fuzzy Systems*.

(2 marks)

(b) The real world is complex generally due to uncertainty in the form of ambiguity. Describe the TWO types of uncertainty and its solution.

(2 marks)

(c) Fuzzy relations map elements of one universe to another universe through the Cartesian product. The strength of the relation between ordered pairs of the two universes is measured with a membership function. Consider $R_1 \in X \times Y = \begin{bmatrix} 0.8 & 0.3 & 0.9 \\ 0.1 & 0.2 & 0.5 \\ 1.0 & 0.4 & 0.6 \end{bmatrix}$ and $R_2 \in Y \times Z = \begin{bmatrix} 1.0 & 0.2 \\ 0.6 & 0.3 \\ 0.5 & 0.7 \end{bmatrix}$ as the fuzzy relations of the universe of $X \times Y$ and $Y \times Z$ respectively. Compute the Max-Min composition of $R_1 \circ R_2$.

(6 marks)

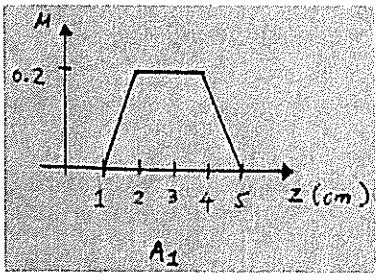
Question 2

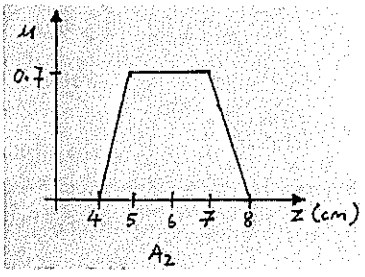
(a) Fuzzy inference is the process of formulating the mapping from a given input to an output using fuzzy logic. Compare the TWO types of fuzzy inference system.

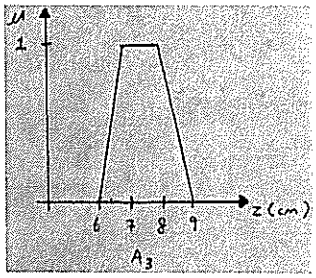
(2 marks)

(b) The fuzzy output cannot be used to the applications. Hence, it is necessary to convert the fuzzy quantities into crisp quantities for further processing. This can be achieved by using defuzzification process. Given the following THREE fuzzy sets, compute the crisp value using defuzzification of: 1) Weighted average method, 2) Mean max membership method, and 3) Center of sums methods. Illustrate the each of the defuzzcication process.

(6 marks)







(c) In 1975, John Holland introduces Genetic Algorithm, an algorithm based on the mechanism of natural adaptation and evolution. Explain crossover and mutation as the operators of Genetic Algorithm.

(2 marks)

Continued.....

Question 3

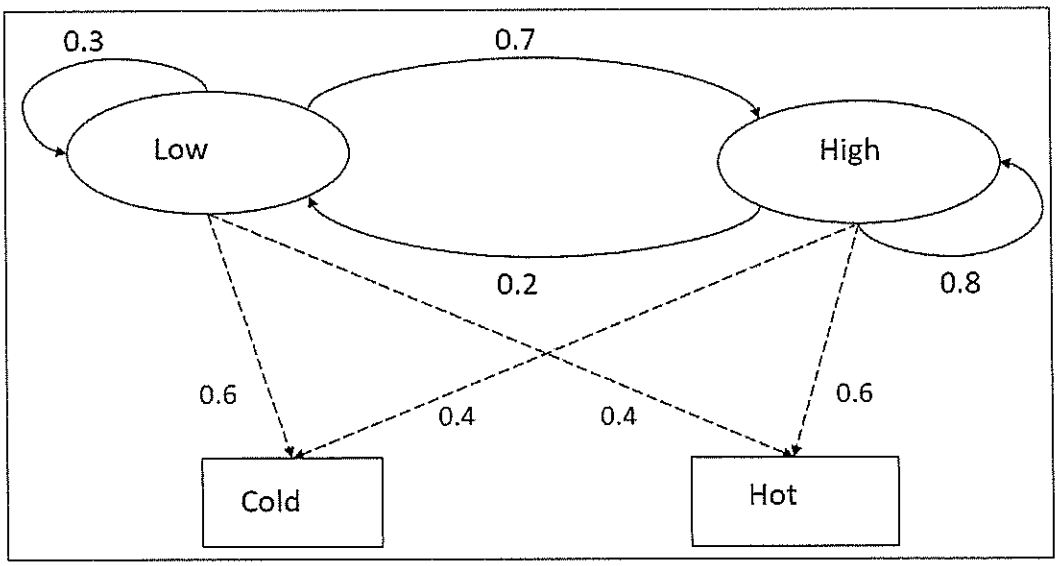
(a) The main problem of gradient descent is that it be trapped into local minima. This can be solved using stochastic algorithm. Explain how the stochastic algorithm works.
(3 marks)

(b) Genetic Algorithm (GA) is modeled based on natural evolution. In contrast, Particle Swarm Optimization (PSO) is modeled based on the unpredictable choreography of a bird flock. Both GA and PSO are the example of stochastic algorithm. What are the similarities between GA and PSO as a stochastic algorithm.
(2 marks)

(c) AlphaGo is a computer program that plays the board game Go. In October 2015, AlphaGo became the first computer Go program to beat a human professional Go player. List out the objective, state, action, and reward of reinforcement learning used in AlphaGo.
(2 marks)

(d) In order to build an optimum model, we need to find a balance between bias and variance that minimizes the total error. Illustrate the bias-variance tradeoff. Then, describe the error due to bias and variance.
(3 marks)

Question 4



Given the above Hidden Markov Model (HMM) of atmospheric temperature, find the following:

(a) What are the states of this HMM? (1 mark)
(b) What are the observations in this HMM? (1 mark)
(c) List out the transition probabilities. (1 mark)
(d) List out the observation probabilities. (1 mark)
(e) Given the initial probabilities: P('Low') = 0.4, P('High') = 0.6, calculate the probability of all possible hidden state sequences of {'Hot', 'Cold'}. (6 marks)

End of Page